REFLECTIONS ON PLAGUE

AND

THE METHODS OF CHECKING IT

(With Letters to the Press).

BY

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The discussion on plague at the recent Corporation meetings in Bombay could hardly have enlightened those of the public who are not initiated in the mysteries of the epidemiological observations on plague. On the contrary it has puzzled the minds of the public on the question of inoculation, and the net result is absolutely nil. It is to be regretted that there were only a few speakers who fully realised the responsibilities and fewer still who understood the problem, but none worked it out. No doubt there were some sensible speakers who knew something about the subject, but they touched only the fringe of it and sat down. Others wisely did nothing and listened to the speakers in expectation of learning something new, but nothing new was forthcoming.

I therefore venture to discuss the various measures which have been hitherto suggested in and out of the Corporation, and particularly the measure which I suggested for the *exclusion of rats*, and the measure I

herein suggest for the *extermination of fleas* to which the people have paid little attention.

More than a year ago I wrote in the *Times of India* that half the battle had been won against plague because we then definitely knew the etiology thereof, which was until then uncertain, and the mode of the diffusion of infection. These have been confirmed by further observations and researches since made in India and elsewhere. The facts so brought to light and the logical conclusions to which they irresistably lead may, without my going into the methods of investigations and the process of reasoning which led to their discovery, be stated in plain language as follows :—

1. Plague is primarily a disease apparently of the rat. It is not a disease of the filth or of the poor, as is thought by some, nor of the locality as was believed at one time.

2. Out of 4 (perhaps more) species of fleas known to exist on earth, 3 have a predilection for the rat as their host in the first instance. Hence they are called rat-fleas. They breed on the ground and in houses, in the dust and under mattings, and in the corners and in the cracks, and in rat holes and nests, lay their eggs there and attack the rat whenever convenient. In the absence of the rat they attack other lower animals. It is only in the absence of

these that they bite a man but not unless they are hungry, and they generally do not get hungry after being fed on a rat and separated from it till after the lapse of twenty-four hours or so. This partly accounts for the interval between a rat death and a plague case.

3. Of these rat-fleas one species alone (*Pulex cheopis*) is known to imbibe the poison from the rat, to retain it in its body with all its virulence for a considerable time, and to have the power of inoculating it into man.

4. *Pulex cheopis* is, according to the highest authority (Rothschild), known to exist only in warm climates. It does not exist in Great Britain and Ireland nor in the greater part of Europe. This, I believe, is one of the reasons why plague is incapable of taking root in Europe. It is therefore not sanitation alone which keeps the plague out of Europe. It is not a respecter of person nor of colour nor of place.

5. Though plague originates with rat, and therefore the rat is a necessary link in the plague-chain, the plague rat by itself is impotent to give plague to man. We do not know yet how plague originates in rat.

6. *Pulex cheopis* serves as a fit intermediary to convey the infection from rat to rat and from rat to

man. But for this species of flea there would be no plague. Shortly speaking, " no flea, no plague."

7. During the epizoötic when rats most suffer *Pulex cheopis* is found in abundance on the rats. When the epizoötic ceases the rat is free from *Pulex cheopis*.

8. It is in the season of fleas that the epizoötic prevails. May it not be that *Pulex cheopis* is, in fact, the origin of the epizoötic in addition to its being the disseminator and inoculator of the plague germ? and may this fact not also account for the absence or prevalence and the lesser or greater virulence of plague at times in the same cities depending on the mercy of this species of flea being found in abundance or not?

9. Rats eat each other when starved. *Mus decumanus* (the drain rat) being stronger than *Mus rattus* (the house or ship rat) would devour the latter if the former finds not enough rubbish, filth and garbage to feed upon. Avoid therefore offering *Mus decumanus* this food, and the consequences will be the same as in Europe, where *Mus rattus* does not exist on that account. The supply of his food can be cut off if the town is thoroughly scavenged and filth and garbage immediately removed by the Municipality, and the drains of

Bombay, which are notoriously insanitary and which provide food for *Mus decumanus*, are cleaned and in some parts improved.

10. One *Mus rattus* would eat another up if man does not provide for him food-stuffs, grain and produce.

11. In some exceptional cases a person coming into contact with the plague bacilli, squirted by *Pulex cheopis* or by the plague-infected rat in their droppings, catches plague provided the contact is with a recently abraded portion of his person.

12. In other exceptional cases a man suffering from pneumonic plague directly gives plague through exhalations to another person attending on him.

In addition to numerous instances in India which may be cited in proof of the flea theory, if any further proof is needed, it is found in the flea-bite marks lately discovered in Sydney on the persons of plague-stricken cases.

Knowledge of these facts is more than half the battle won for they show that plague and the enormous loss of human life in consequence thereof are, as his Excellency Sir George Sydenham Clarke has rightly said, preventible. To win the whole battle what more is needed than to take measures to avoid the rats and kill fleas wherever

and whenever it is possible to do so. I shall show later that fleas can be, to a certain extent, got rid of.

One other fact may be added to the knowledge already acquired, and that is the incidence of the epizoötic on that part of the town where there are produce stores and which is in the immediate neighbourhood of the dock line at which produce is landed. This is a fact of no little importance to be taken into account in resolving the plague problem. We know how plague begins. We do not know how epizoötic begins, but we do know where it begins, and the knowledge thereof is another step forward in the history of plague investigation which should enable Government to hit upon the right measures in the right direction. In Asia it took its start at its several ports. In Japan, China and Australia it did the same. Not only that, but in each port it commences and continues on the harbour wharf line. It is a well known fact that in Bombay it commenced eleven years ago at Mandvi, and at every seasonal recurrence thereof it commenced there and has again commenced at the same place. Then it gradually spreads to the surrounding localities. It has already begun to affect its immediate neighbourhood. Bombay was undoubtedly the source whence both the epizoötic and the plague found their way to other places in India, and there is also no doubt that Bombay is now and again receiving the same back from them in its turn.

This has also been the experience of Sydney. Taking the last report alone, the reader will find that plague rats, in 1906, were identified there "on 48 premises, of which a large majority were *as usual* either wharves on the Darling Harbour wharf line, or business places within the Darling Harbour area" ; and it has been authoritatively established at Sydney that Sydney also is receiving plague from, and giving it back to, other places. It must, in passing, be acknowledged to the great credit of the Australians that they have, without taking advantage of M. Haffkine's prophylactic, so far controlled plague at Sydney, and therefore all over Australia, since the first outbreak in Sydney in 1900, that throughout the last year the fatal cases in Sydney dwindled down only to eight, three of which were discovered to be plague cases after death.

Similar is the latest experience of Calicut, which has been now affected for the first time and where also the plague rats were first traced to, and are, I believe, still confined to the wharves on the shore.

Does not, therefore, this knowledge of the incidence of the epizoötic on produce and grain godowns indisputably lead to the conclusion that if plague is to be eradicated from India at all, the fountain head thereof, namely, not Bombay but *the Mandvi of Bombay* (I mean the Bombay Harbour and all the wharves on the

line, the grain and produce godown and the district of Mandvi) should be attacked with all the force of the Indian Government, and no measures which can possibly stop the infection, particularly by rats going from ship to shore and shore to ship, should be regarded as too strict? Such measures are neither too difficult to devise nor too difficult to carry out. As for instance, Government might legislate that every ship coming from any port which is, or which was once infected should, on entering the harbour, submit herself *with all her cargo* to the fumigating staff for a thorough fumigation, in the same manner as is done in Australia and measures should be taken to search out and kill every rat which might survive the fumigation so as to prevent its migration to the shore; and like measures should be taken on the shore to see that infection is not conveyed to ships either in the shape of rats or of fleas generally found on the goods and effects of the people who move out from quarters where fleas are in abundance; for, though it is not necessary to examine the person of a human being before he is allowed to travel, it is absolutely necessary that the effects taken or the clothes worn by him should be free from the infective agents. It has just been brought to my notice that the clothes of native sailors for the P. & O. and other steamship Companies are disinfected at the Docks in the way I have mentioned before they are allowed to

go on board, and there has not been a single case of plague among them after such precautionary measures, although they fall victims to plague when they reside in the town.

In addition to this the Port Trust, who have the control of the grain and produce godowns in their hands, may deny access to the same until structural alterations for making the same rat-proof are made and continued, and produce, etc., are kept in rat-proof receptacles.

Apart from this the authorities should draw upon other countries for a staff of *expert* rat-catchers, and through them destroy as many rats as they possibly can without entering the apartments of unwilling persons, but at the same time they should keep a vigilant watch to prevent the residents from adopting any action, hereinafter referred to, which is calculated to create fresh centres of plague.

These observations on the incidence of the epizoötic lead us irresistibly to eliminate from our minds the supposed origin of the epizoötic in the Bombay drains, for, if drains where the origin, the epizoötic would not always commence and continue to be at Mandvi alone, and the experience of the other ports above referred to points to the same conclusion that though the rat is the origin of plague, the origin of the epizoötic is anything but drains.

Though I believe drains are not the origin of the epizoötic, the condition and the acknowledged defects of the Bombay drains do, I think, indirectly assist the existence and multiciplity of *Mus rattus* by providing enough food suitable for *Mus decumanus*, which has therefore no motive to attack and devour the *Mus rattus*, and the existence and multiplicity of *Mus rattus* makes it possible for the epizoötic to spread in Bombay to the extent we painfully observe year after year.

While on this part of the subject, I may mention that it has been a puzzle to many why it is that neither the Government nor the Improvement Trust have ever yet thought of destroying this part of the town, except a bit of it (Kolyvada), or at all events a greater part of it, or why, under the Epidemic Diseases Act, a large majority of the houses therein, or the ground floors thereof at any rate, and godowns of grain, produce, etc., have not yet been declared unfit for human habitation. To purify must be the first object; to beautify, only a secondary one. Is it too much to expect Government to incur the expense of destroying some parts of Mandvi to save not Bombay alone but hundreds of cities in India and elsewhere from the recurring scourge? The highly congested state of Mandvi must ever remain a stumbling block in the way of any appreciable advance towards diminution of the epizoötic. It is for the Government to consider whether once for all they

should not seriously consider this problem and spend large sums of money to clarify that part of the town which is at present a blot on it.

Having dwelt on the incidence of the epizoötic and the measures which could be adopted to prevent the infection being imported into and exported from Bombay year after year and being allowed to settle down in a congenial locality like that of Mandvi, I shall now dwell on the relative merits of other measures which may be taken either by the authorities *without* the co-operation of the people or by the people themselves.

The former class of measures are the most important, and fall under the following heads. While discussing the same I assume that *a large staff* of persons to help the authorities will be brought into existence, which ought to be independent of the Municipalities, as the latter have already enough to do to look after the sanitation of the cities. The Secretary of State has already offered to send down a large staff, if necessary, of medical gentlemen, but it is not necessary to undertake this expensive proceeding. It would be enough if a staff of surveyors or inspectors, interspersed by medical men, is employed in each city troubled by plague and all placed under the control of a Chief Plague Officer.

A.—Plague Inspection.

Enough experience has now been gained to show that infection is diffused either by the man or the rat conveying fleas, or by merchandise or grain and produce being sent oversea or overland or from one part of the city to another, and the fleas so imported with it produce the epizoötic, and through it the epidemic plague. Where the fleas, being very few, do not come in contact with rats but with man only, there are only a few cases of plague and nothing is heard about "the epizoötic." Such was the experience of Panchgani and Mahableshwar and of the Purandhar village this year. The Purandhar village, to which plague fleas were conveyed by a Hindu bride from the plague infected city of Poona, however escaped the epizoötic for the reasons above stated. Such being the mode of the spread of plague, Government will be well advised to think seriously whether they should not resume measures to check such spread by means of fumigation, or exposure to the sun, of all merchandise, etc., imported and exported, and of clothes, beddings and other materials carried by travellers whose circumstances in life or habits of living or whose occupations do not permit of their keeping clear of the fleas.

B.—Framing of Rules to be observed by the people and the Municipalities.

Under this head the authorities ought to take effectual measures—

(*a*) to prevent the throwing about anywhere and everywhere of rats either dead or alive. In some cases they are caught alive and carried and let loose about a mile away from the residence of the catcher.

(*b*) to have all garbage and rubbish removed from the streets at frequent intervals of the day so as to prevent the sight we now see of garbage and rubbish, etc., collected in dustbin carts close to the roads where rats abound or lying on the ground for hours together before their removal.

(*c*) to see that all rubbish, etc., is, until removal by the Municipal carts, thrown into covered receptacles provided for the purpose by the Municipality for each house, and that it is not thrown either in gullies or anywhere else.

(*d*) to see that all houses unoccupied either on account of their being dilapidated or declared unfit for human habitation are repaired or destroyed forthwith, for it is admitted on all hands that such houses harbour and breed rats and fleas and

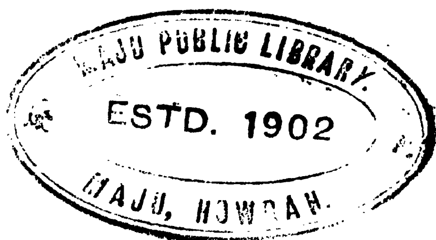
anything that harbours rats or provides them with food prolongs their existence and enables them to multiply them and is calculated to frustrate or thwart measures for the prevention of plague.

(*e*) to obtain immediate information about rat mortality, which is more important than that about plague mortality.

(*f*) to prevent kitchen stuffs, &c., being thrown into gullies and streets ; for, they provide abundant food supply to stray cats and kill their natural instinct to live upon rats.

(*g*) to keep drains and sewers clean and free flowing, so as to avoid collection therein of filth, silt, etc., which give plenty of food to rats.

Much and very creditable work will, therefore, have been done by the authorities if they would forthwith embark upon these measures which do not or ought not to involve any consideration for the feelings of any class of the people, and in order that the same may be effectually carried out the scope of the Epidemic Diseases Act may, if necessary, be widened.



C.—Rat Destruction.

Individual efforts to kill rats will never succeed in exterminating them. It is therefore necessary that Government should take up these measures in their own hands. Two kinds of staff should be employed.

(*a*) An *intelligence* staff for the purpose of studying the characteristics and tracks of rats and to search them out.

(*b*) An *expert rat-catching* staff to catch the rats at night with traps or to poison them, particularly before the epizoötic sets in, wherever and whenever they can get a chance of doing so, leaving aside that section of the community which has any particular objections to this course. Anyone knowing the habits of rats would know that they do not resort again to places where they are caught or poisoned, or at all events avoid such places for a period. It therefore does not matter if a particular section of the people would not join in this operation, for in that case that class will eventually find itself in the position of the only people to whom rats would resort in abundance. This is unfortunately a measure which people cannot take upon themselves to carry out successfully and effectually, though a majority of the residents in Bombay would no doubt be only too willing to assist the Government

in doing so, but as a *condition precedent* it is absolutely necessary that there should be sufficient men in each locality at the beck and call of the residents to give them whatever help is required at any time. I repeat, as I have always in my letters to the Press done, that Government need not be deterred from adopting these measures whole-heartedly simply because there is a very small part of the total population of Bombay which does object to such a course. I have however reason to believe that Marwaries and high class Hindus will allow rats to be trapped in their houses and carried away alive, provided men not of low caste are employed to do the work. No doubt religious susceptibilities must be respected, but only so long as they do not thwart measures calculated to prevent the spread and eradication of plague. People require, in the first instance, to be guided and helped and to be taught their duties. Even intelligent Australians had to be instructed in their duties before the measures taken there began to be effective.

D—Extermination of Fleas.

This is a measure to which little thought has been bestowed, and yet it seems in the near future to promise to be the best and the most effective measure. Assuming that without fleas (*Pulex cheopis*) there is no plague (except in very rare instances through the rat excreta) it is important that we should not allow our attention to be diverted only to the rat. That fleas play the greatest mischief is abundantly clear from the fact that, when the flea season commences, not only are the fleas in abundance but they are *found in abundance on the rats* during the epizoötic, and that when the fleas die out, the epizoötic nearly dies out also. The fleas generally breed on the ground and in rat holes and nests, and in the dust, in unclean, ill-ventilated and ill-lighted rooms, and in defective drains and under matting. The only way to kill them wholesale is by smothering them either by crude petroleum oil or by fumigation. As the former cannot reach all parts of buildings, fumigation is the best, and fumigation by hydro-carbon is known to kill fleas and all lower animals. Now that the flea season has commenced in Bombay, steps taken to kill the fleas outright in the houses above described and in all outhouses, stables and residences of the poor would be of great advantage. Last year's low plague mortality was, I believe, due to a timely though not sufficiently systematic and

sustained action taken by the Municipality in killing rats in the Fort Ward at a time when the flea season had commenced. The result was that large numbers of plague infected rats did not go forth from the Fort to the outlying districts as usual to spread plague.

Before I refer to the measure for the *exclusion of rats* from premises, I shall deal with the measures commented on in the press.

1. SANITARY MEASURES.

These will help in not breeding fleas, but no buildings, however built on sanitary principles, will be rat or flea-proof unless the measures below mentioned are adopted by the people; for, if such buildings harbour rats or provide them with food-stuffs, they are as much liable to be infected by plague as a *bustee.* Therefore sanitary measures by themselves are not of much avail.

2. EVACUATION.

It is no doubt a sound measure to avoid plague, but it is only a palliative. It does not get rid of the chances of spreading it or of diminishing the epizoötic and is accompanied by innumerable inconveniences to those who can afford the luxury of changing residences, and all cannot have either the means or the opportunities of changing places, especially as the Bombay Govern-

ment have by a Resolution stopped open sites on the foreshore being utilized for Health Camps. Government would, no doubt, be right if they have done so on the ground that in the present uncontrolled circumstances such camps in the heart of the cities with fleas imported there are likely to create fresh centres of infection.

3. PROTECTIVE INOCULATION.

As a rule it saves life for the season, notwithstanding its after-effects on certain constitutions. People, whose avocations in life or whose circumstances or habits of living do not insure their keeping clear of fleas, will, if not inoculated, be constantly exposed to the risk of infection ; but it cannot be denied that the epizoötic will continue and the conditions giving rise to plague will also continue. Thus inoculation, though saving life, has not the merit of removing the cause, and so long as the cause exists the inoculated person, *e. g.* a doctor on plague duty, who is lulled into security, will be the free and unsuspected agent to carry fleas to his house, and a servant likewise inoculated will carry fleas to his master's house and introduce plague, unless the whole household is inoculated or the agent is segregated, as is done in Australia, or has otherwise taken precautions to get rid of any stray flea on his clothes or person. Instances are not few of plague being thus spread among persons who have never moved out of their houses and to

whose houses or even to the locality to which they belong no plague rat has been traced. A man living in plague surroundings is not always the first to suffer. He may not suffer at all, and yet be the means of introducing plague to others who have never been in those surroundings.

Likewise merchandise, produce, food supplies, gunny bags, sacks, clothes, beddings, etc., will continue disseminating infection all the same, wherever they are carried to, by conveying with them the medium of injury, the flea, and the infection diffused by such mode cannot be prevented by inoculation unless all are inoculated and continue to be inoculated year after year.

Remove the precautions above referred to which are being taken in the case of the native seamen, and they will carry infective agents to different parts of Europe and Asia to give the plague or both the epizoötic and plague, as the case may, be according to the conditions of those parts unless all the people there are inoculated in the manner abovementioned.

EXCLUSION OF RATS.

But as inoculation cannot and will not be availed of to the extent abovementioned and as, in spite of inoculation, it would not be after all safe to remain in a house after dead rats are found therein, we have to look for another measure in addition to the measures above referred to, which would have the merit not only of avoiding plague but of indirectly exterminating a large number of rats and thus diminishing the epizoötic, and that is the *exclusion of rats* from the houses. This is a measure which I have for the past twelve months advocated, but either my plans have not been understood or I have not made myself sufficiently clear. It is a measure calculated to adopt little dodges to prevent rats from entering residences. Some of such dodges are to deposit red (perhaps also black) coal tar in small vessels in the corners of the rooms; the smell of it turns the rodent away, and it is the habit of the rodent not to frequent the burrows or places where anything is placed to which it is averse. Another thing which I have noticed is that if in small vessels green powder paint, containing I believe arsenic, strewed over with white flour is deposited in places, a rat or two eating the same will go out and die, but it is certain that for some time thereafter no other rats will resort to that place.

A similar experience has been that of Dr. Ashburton Thompson who recently tried Danysz's rat-virus baits at Sydney not with the object I am seeking for, but in order to destroy all rats. He failed in securing his object, but has succeeded in justifying my suggestion by observing that, as a result of the laying of baits, all burrows of rats where the baits were laid were deserted and the rat-runs showed signs of disuse.

Anything therefore that frightens away this most suspicious animal or any smell, as, for instance, that of petroleum or crude oil or of the red (perhaps also black) coal tar, against which it sets its face, turns the animal away and for good. For months past I have thus and by other means secured my premises, although my immediate neighbours, not adopting like measures, are unprotected. Why not, therfore, adopt this course as the most simple and least costly ? In some instances ordinary kerosine oil when sprayed on the floor has kept the rodent away for days together. This course, though not practicable in well-kept houses, may be adopted in the houses of the poor.

Another course which destroys rodents as well as the fleas and keeps them all out for a long time, if not permanently, is the fumigation by hydro-carbon above referred to. It has succeeded on the

Southern Maratha Line in Dharwar and other places under the supervision of Dr. Chenai. This plan has also succeeded in Poona in the flea season.

Other measures which can be adopted to prevent the entrance or harbourage of rats or harbourage of fleas are :—

(*a*) To close at night the doors leading from staircases to the apartments.

(*b*) To search out and stop all holes through which the rats find their way into dwelling apartments or into food or produce stores.

(*c*) To stop by gratings the mouths of sullage pipes.

(*d*) To cut off branches of trees close to the houses (rats live also in the trunks of trees and enter houses by climbing up the trees).

(*e*) To leave no space for rats to harbour between the top of a wall and the roof.

(*f*) To keep nothing in the house such as hay, firewood, cowdung cakes, lucerne, bamboo matting, etc., which harbour fleas and to keep the floors smooth and clear of dust.

(*g*) To daily wash with carbolic soap-water all domesticated dogs and cats in order to kill plague fleas on their bodies if they have caught any. Dogs and cats serving as traps for these fleas in the absence of their proper host, the rat, protect their masters ; but, on the other hand, close and constant contact with them, especially in bed, brings man in contact with the fleas and gives him plague. A European lady and two of her children thus recently caught palgue and died at Panchgani in the course of a week, and a European lady died at Poona last year who was similarly infected.

(*h*) To pour hydro-carbon into rats holes.

It will thus be seen that well-constructed houses built on sanitary principles are useless, so far as the plague is concerned, if they provide facilities for entrance of rats and consequently the collection of the rat excreta and rubbish or for the harbourage of rats, or if they provide rats with food-stuff through pantries not being kept rat-proof and kitchen stuffs not being kept in close vessels. No wonder if the Agripada and other chawls built on sanitary principles get infected. For materials such as bamboo matting, etc., are found there which harbour rats and fleas. Drain-pipes should also not be directly connected with the drains, thus giving facilities to the rodent to obtain access to the rooms. The resi-

dents should be prevented from using such bamboo matting as one sees in the chawls built in the Princess Street. A little guidance in that way will go a great way towards realising the desired effect.

In connection with this it must not be overlooked that such houses in Bombay as have no wooden or tin-sheet ceiling must be provided with one as a necessary measure.

The result of adopting these measures which are neither costly nor difficult nor impracticable will be to avoid rats coming to the premises wherein such measures are adopted, and avoiding rats would be avoiding fleas except where, in most of the houses of the poor, fleas always breed; in which case hydro-carbon fumigation may be adopted, and by avoiding fleas plague will be avoided; and when rats find neither habitation nor food, they will either devour each other or die, and when by keeping the city clean cats are starved, they will live upon the rats. Such double process of destruction would be a more natural and sanitary measure to bring about the destruction of rats and to prevent their propagation than artificial efforts to take their lives. It would also be a measure most acceptable to every section of the people.

In proof of the soundness of these measures I may cite Calcutta where the houses are more or less ratproof

and where, there being no gullies full of kitchen and other refuse, there is no abundance of food provided for the rats, and the consequence is that the house rat bears a much smaller proportion to the gutter rat there than in Bombay, and therefore the epizoötic is always on a smaller scale, notwithstanding the otherwise greater insanitary condition of that town. This again indirectly proves plague to be not a filth disease but a disease of the rat.

I may also cite the instance of a house in Cawasji Patel Street within the Fort of Bombay which is the only house in the street in which no dead rats from plague have hitherto been known to have been found or in which no plague cases have occurred during the last eleven years, although every other house in the street has had unpleasant experiences, and the occupants of this house, though from 50 to 60 in number, have had no occasion either to periodically clear out of it notwithstanding plague all around it, or to take any other measures besides the ordinary measures referred to above for the exclusion of the rat from the house.

I may also cite the history of the plague cases among the Parsees. A great number of these cases have occurred on floors next to the roof, and which were unprotected by a wooden ceiling in between to prevent

fleas from infected rats on the roof dropping from the tiles on to the floor.

The experience of the military authorities in the Bombay Presidency who are building godowns on modern principles, calculated to exclude rats, also tends to the same result.

One seldom hears of visitors in Bombay hotels being infected by plague in the hotel, the principle being the same. There is hardly any food-stuff in the apartments to make it worth the while of the rat to visit them and carry fleas there, and the dining room is always away from the bed rooms.

Shops containing coal tar and petroleum are, I understand, free from rat nuisance.

Certain huts roofed with corrugated sheets in a village near Poona were many years ago frequented by serpents who were attracted thereto by a large number of rats which the roofs harboured. Subsequently the corrugated sheets of the roof were painted with red coal tar, with the result that the rats disappeared and the serpents followed suit.

Towards the close of each monsoon, the breeding season of the fleas commences in Panchgani and Mahableshwar. Those of the houses there which have re-

cently introduced tile-flooring are no longer now troubled by fleas. Old-fashioned houses having no such flooring are always so troubled. It would, therefore, be as well if a similar change is made in the floors of the Bombay houses.

The best object lesson is, however, afforded by Sydney where the authorities, by constantly fixing attention upon the rat either by catching it or keeping it out of the premises, have so far controlled the plague that throughout last year there occurred only 20 cases, 8 of which only proved fatal.

Although the measures I have suggested are such as the people themselves should adopt, I consider it necessary for the interference of Government by employing a large staff to inspect and supervise such of the houses as they might gain access to with a view to guide the people as to what they should do, and to be always accessible and serviceable to such of them as may require their advice and help at any moment.

I would appeal to the Parsee Panchayat, the Zoroastrian Association and like Bodies in other communities and to the Municipalities to take up this question immediately before the next plague season commences by employing a large staff of men, distributed over different localities to inspect the houses in

their respective divisions, to give necessary advice and help to the people in their jurisdiction, and to assist them even with money where necessary to enable the owners to make their houses rat, and consequently flea, proof.

I am not unmindful of the immense difficulties which would beset any one attempting to carry out these measures in the houses at Mandvi, but that problem must and will have to be solved sooner or later in the way I have suggested above. The wonder is how the inhabitants there manage to exist.

At the most plague will be confined to that district only provided the measures herein discussed are effectively carried out in the rest of the town.

EXPANSION OF BOMBAY.—

This finally brings one face to face with the *Expansion- of- Bombay* problem. This is certainly not difficult to solve. It is only a question of give and take; for if Government lose an additon to their revenue by the remission of the odious impost known as the "building fine" they will gain by the occupation of the extensive tracts of waste land in the suburbs which are not fully availed of at present, and by freeing Bombay and, through Bombay, other parts of India, from this terrible scourge.

It will be observed that I have aimed at, first, the root of the evil ; and secondly, thoroughness of the measures to be adopted to strike at it. Measures not calculated to reach this goal will be disappointing ; and wasteful in money, wasteful in energy. Palliatives are palliatives and will not avail to eradicate the scourge from India unless it is believed that the disease will die its natural death either by the virus being gradually attenuated and weakened in its effects or by the people being gradually immunised. But neither belief will hold good in the case of plague, for it has not lost its virulence all through these eleven years. On the contrary it is as virulent as ever, if not more so. And we know that long familiarity with plague gives no immunity either. Several instances may be cited of men being plague-stricken more than once, and the best proof is in the fact that Haffkine's serum, though immunising the blood against the germ, does so only for a time. What, therefore, cannot be done by artificial means will not, I presume, be done in the natural conditions of life. We must, therefore, fall back on the *causa causans*,—the Common Enemy of Mankind, the Rat,— and the *causa proxima*, the Flea.

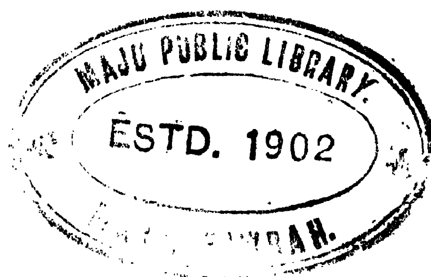
But no measures can and will be effective to grapple with he double enemies unless they are thorough and persistent, and this means the employment of large staffs of men fitted to serve in the different departments

of the gigantic campaign to be carried out to attain the one object, namely, to drive out the enemies from our homes, and if in doing so heavy expenses have to be incurred in destroying or improving Mandvi and improving the drains they must be met, once for all, to replace those which are wasteful. One important part of the work of the staff will be to guide and help the people and to be accessible to them at all times.

Books on hygiene specially written for the purpose should be introduced in all schools at once and made a compulsory subject for study. Knowledge so imparted will be at once thorough and far-reaching. Thus as an initiative Government action is necessary and the co-operation of the people will follow as a matter of course, and that is only a question of time.

PESTONJEE M. KANGA.

Bombay, December 3, 1907.



Times of India,
12 November 1906.

PLAGUE PREVENTION.

A Rat Campaign.

SIR,—Will you allow me to start in your columns a discussion as to the most efficacious available modes of minimising the plague mortality in India, and, if possible, of eradicating plague altogether from this country?

Now that the etiology of plague is established beyond reasonable doubt, namely, that (1) epizoötic plague precedes and is the cause and not merely an incident of the epidemic plague; in other words, that the rat is the *fons et origo* of the infection in human beings, and (2) a living intermediary is necessary to communicate the infection from rat to man and such intermediary is the flea, the question arises whether we have not already half won the battle and whether ultimate victory cannot be secured by well-directed and well-applied efforts under human control.

Though epidemiological observations are very difficult in a country like India, if there is one thing now clearly established above all, it is that, to avoid plague it is necessary either to destroy the rat or to habitually avoid or exclude it. It is also only recently recognised that though filth and rubbish spread the disease they are not

in themselves the cause of it and that scavenging of the same without resorting to the enormous expense of general disinfection gets rid of infection once for all. Such being the given conditions, where lies the difficulty in taking the right measures one fails to see. I concede the difficulty in searching out and killing all the rats, but that is no argument to deter us from taking all steps in our power to exterminate as many as we can provided it is done in the right way, at all events in the epizoötic area. The difficulty of killing the rats has been the hue and cry in Bombay ever since the visit of plague.

The mere destruction of a certain number of rats in a given time is not sufficient. Has any one inquired what steps have been taken and with what results in other countries, especially Australia? The very mention of Australia will evoke an answer that the conditions in that country are not the same as those in this, but is that any reason why the methods adopted there should not be investigated, discussed, and, if practicable, adopted before they are summarily condemned and rejected? It was discovered and recognized in Australia as far back as 1903 that it was not so very important to kill rats as to exclude them from the premises. May I ask if any steps have been yet taken in this country to exclude rats from buildings? I use the word build-

ings advisedly, far apart from buildings there is no plague. We have thus to concentrate our efforts on two points only, namely, (1) the destruction, and (2) the exclusion of rats.

I therefore suggest that a committee of select persons be formed without loss of time to make suggestions on the above two points, which, if found practicable, may be crystallised into rules, and if necessary, into law, and steps should be taken to familiarise the millions of this country with them. In most cases the desired effect will be obtained by taking the people into confidence, by educating them as to the necessity of observing those rules, and by house to house inspection without necessarily wounding the susceptibilities of the people.

As a first and foremost measure I venture to suggest that a sufficient staff should be employed to entrap, kill, or to poison rats simultaneously all over Bombay, if possible, but over the epizoötic area at all events, and during the plague-free intervals over the area which experience has shown to be the starting place of plague and the focus of danger. Unfortunately the measures now adopted are, so far as one can see, hardly exhaustive or of much value.

Next there should be an intelligence staff employed to be constantly on the watch for, and to search out,

rats. No doubt it will be found that in three out of four visits their work is doomed to failure, but that is only to be expected in the case of rats. Persistent efforts are sure to bear fruit.

As to the particular mode of killing rats and of employing a special corps of experts to prepare rat baits and to distribute them broadcast among the people, I need not give the details, but I cannot conclude this subject without stating that without the expenditure of Muncipal funds, steps can forthwith and easily be taken to prevent the spread of plague by seeing first, that all rubbish and filth is properly scavenged and that no rubbish or refuse is so placed as to attract rats towards it, and, secondly, what is of greater importance, that structural repairs are made in every building so as to prevent as far as possible the access of rats to and harbourage of rats in or about the premises.

Another matter which seems to have been overlooked in Bombay is to prevent by legislation the migration of rats from ship to shore.

I have purposely abstained from giving details of the measures for I consider that, once the principle is accepted, the methods are not difficult to formulate and adopt.

PESTONJEE M. KANGA.

Times of India,
19 November 1906.

PLAGUE PREVENTION.

A Rat Campaign.

TO THE EDITOR OF THE "TIMES OF INDIA."

SIR,—I have read with interest your powerful leaders on the important subject of plague in the issues of 12th and 15th instant, the more so as they are fully in accord with the views outlined in my letter published in your paper of the 12th, though without the same advantage as you had of being fortified by the conclusions arrived at by the Plague Research Commission. The only difference is that, whereas I put before the public the conclusions arrived at more than three years ago and confirmed over and over again since in a country where the customs and habits and discipline of the people afford an easy scope for epidemiological observations (and which conclusions were twice brought to the knowledge of the Bombay Municipal authorities in the course of last year), you have published the same conclusions arrived at only to-day in Bombay.

I fear that my letter has given rise to a misconception in your mind as to the methods I wish adopted to combat plague, for you refer to a cry for "legislation" having been recently revived, and I presume you refer

to my letter. Far from it ; I intended to convey, as you have done, that measures should first be formulated in the shape of rules, and ways and means should be devised to make the people familiar with them, and that only very few of them, which it may be found absolutely necessary to codify into law without necessarily seeming to be oppressive, may be so codified.

You rightly refer to the painful experience of the plague measures adopted by Government some years ago; but I would remind you that, with a man at the helm of the type of General Gatacre, whose methods of dealing with the people were very adroit and therefore popular, the Government need not fear opposition, but may well now expect every assistance and encouragement from the people who have suffered enough and who only require to be handled in their own ways.

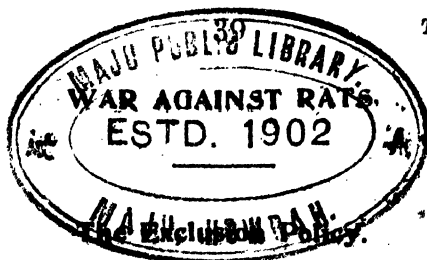
You also refer despondently to the results arrived at in Japan; but, however right you may be in being sceptical as to the results in a city like Bombay and the native town of Poona, where difficulties are admittedly many, will you not admit that in the mofussil there is ample scope for a campaign against rat and with success? Not long ago you published remarkably favourable results of such campaign in Bangalore and Mysore. In Akola I was informed that the results were still better. Last year their plague mortality per

day was 70. This year it is only 12. This shows that whatever may be the difficulties one has to face—and they will have to be faced sooner or later—the results are not altogether discouraging. If all the rats cannot be killed, many of them will be, and the plague will be reduced in proportion.

There is one other interesting point discovered in connection with fleas in Australia which may be verified in Bombay. It is that the presence of cats or dogs in a house very often keep their masters immune from plague, the reason being that fleas go to human beings for food only as a last resort. So long as there are lower kinds of animals on the premises, they are the fit hosts which the fleas have predilection for. If these animals, like guinea pigs, are susceptible to plague, they die, and the fleas seek other hosts, and in the absence of other animals, human beings. Dogs and cats do not easily succumb to plague, and hence, though fleas are on their bodies, both they and their masters go to a great extent free. I do not know if for the same reason syces escape plague. No place is more infested with rats than a Bombay stable, and yet one hears rarely of plague mortality among syces. Such as may have died must have come in contact with fleas outside the stable.

PESTONJEE M. KANGA.

Times of India,
6 February 1907.



WAR AGAINST RATS.

The Exclusion Policy.

TO THE EDITOR OF THE "TIMES OF INDIA."

SIR,—No one, who has read your articles during the last three months on the plague, and our present knowledge thereof, can have failed to recognise the powerful support you gave to the Plague Commission by bringing home to the public, in non-technical language and with a masterful pen, the indisputable conclusions of the Commission, supported, as they were, entirely by independent observatious made by and under the directions of men like Dr. Ashburton Thompson. But have these conclusions been yet put into practice, though they were first published nearly three months since?

No good can be done by repeating them here, but you have properly summed them up in one word 'Rat-flea-man.' The leading and perhaps the only idea underlying the whole of the recent observations is 'avoid rat fleas.' This, I submit, can only be done by habitually excluding rats or by destroying all rats.

It is the general experience of experts that destruction of all rats, especially in a town like Bombay, is well-nigh impossible. The attack, therefore, which has been made in the Fort section for one day only cannot be regarded by anyone having the slightest acquaintance with the characteristics of the house rat as anything more than a very partial measure. As I explained in one of my letters in your columns in November last, the proper method to kill the rodents is to do it continuously and simultaneously all over the town, and by the employment of none but those who are experts in the preparation of baits, and lastly, by the employment of an intelligence corps whose duty will be a very painstaking and arduous one, to be constantly on the watch for and to search out rats.

Rat-killing has proved marvellously effective and profitable in small villages as in the Punjab, where the measure can be adopted simultaneously all over the place and not merely in parts ; but, having regard to the experiences of Japan on the same subject, what appears to be the most important measure is the alternative I have above mentioned and is what I suggested in your columns three months back, *viz.*, to exclude rats from buildings. To make the roofs rat-proof and to make the houses rat-proof is the only measure suggested by the conclusions of the Plague Commission. The

only questions are "How to do it?" and "Is it difficult or even costly, at all events, to try it, and is even legislation necessary for the purpose?" It may not be always possible to succeed; but why beat about the bush and not face the difficulty and go in the right direction? The Municipal authorities will do well in employing a fairly intelligent staff, who, after a previous training, should inspect each house which they may be allowed to enter, and point out to the occupants thereof in what respects it is accessible to the rodents and to suggest how to make the place inaccessible. I am aware that all will not care to follow the suggestions, but many will. Stopping up passages is not the only way to exclude rats. Anything that frightens the rat, *e.g.*, poison, red coal tar properly placed and properly used, and the absence of anything that attracts or harbours him, will make him perhaps permanently avoid the place. There are about 40,000 houses in Bombay. A hundred men inspecting 1,000 houses a day will complete one round in 40 days, and may repeat such inspection as occasion arises.

Again, out of the 40,000 houses, 25 per cent. of them only, I understand, have their roofs which are not rat-proof. The Municipal authorities can easily induce the owners—not by threats but by persuasion —to change the style of the roofs or to do what is called beam-filling by carrying the wall high up to meet the

roof so as to leave no possible space for the rodents to harbour between the top of the wall and the roof.

I again take this opportunity to call the attention of the authorities to the fact that no steps whatever have yet been taken to prevent migration of rats from ship to shore and *vice versâ*, although it is an established fact that plague is transmitted by water.

PESTONJEE M. KANGA.

Times of India,
11 March 1907.

NEW LIGHTS ON PLAGUE.

A Lesson from Calcutta.

TO THE EDITOR OF THE "TIMES OF INDIA."

SIR,—The discovery in Calcutta of the fact that *mus rattus* bears only a very small portion in that city to the other kinds of rats, referred to in your leader of the 6th instant, takes us, I think, a step forward in the history of plague investigation in India. It rightly accounts for the paucity of plague cases in Calcutta, and therefore one must pause here to inquire — what is then the reason of the small prportion of the house rat which has the effect of confining the epidemic within moderate limits? It is well-known that *mus rattus* (the black or ship or house rat) prefers upper floors and roofs and feeds on grain and fruits. *Mus decumanus*, though equally susceptible to plague and equally capable through fleas of giving plague to man as well as to other rats, is the grey rat living in burrows and cellars, infesting sewers and feeding on garbage, and rarely comes in contact with man or his belongings as it avoids dwellings. Therefore man is safe against it even if it suffers from plague. It therefore follows that if there are fewer dwellings suitable for *mus attus*, or which supply food to it directly or indirectly,

this kind of rat population must in course of time diminish.

Does Calcutta then supply these conditions? I believe it does. Most of the houses — at all events of the well-to-do and of the middle class — have their roofs rat-proof, because they are "flat." Very few houses are there which, after the fashion of Bombay houses, have their roofs suitable for harbouring rats and fleas. Had it not been for such few houses and for the *bustees*, which are collections of small huts with walls of bamboo matting plastered with mud and with bamboo roofs covered with country tiles, and which are therefore the most suitable for the house rat, Calcutta would, I imagine, escape plague altogether, notwithstanding its notoriously insanitary condition.

If the above observations have any force, then I am entitled to reiterate my suggestion that the authorities in Bombay should do all they can to induce owners of houses with objectionable roofs to change the style of the roofs and to induce the owners of godowns at Mandvi to so improve them as to make them less easily accessible to rats.

In this connection I would draw the attention of the public to a very important contribution by Dr. Ashburton Thompson on the epidemiology of plague pub-

lished in the October number of the "Journal of Hygiene" of last year, kindly sent to me by its author, and would here refer only to two of the topics therein discussed, which stand out very prominently. Briefly stated they are as follows:—

(1) "The rats must die before man can be attacked. Dead plague rats, devoid of fleas, are harmless to man. Infection has been found external to men's body, only in the bodies of lower animals and the fleas which have the power of taking the infection from the rat and of inoculating it into man are the only intermediary insects which communicate plague to man. Fleas leave their proper hosts, when the latter die or are withdrawn, in order to seek food from the next nearest animal. This explains why man takes plague only after rats "have died of it."

I submit that the above observations, which are also the observations of the Plague Commission in India, justify the following conclusions, though I am not aware that they have as yet been suggested anywhere, *viz.*:—

(*a*) It is a mistake to kill rats by poison except during the plague-free interval, because if such rats happen to be plague-infected, fleas are let loose from them on their death to seek food from man unless there is another animal, such as a cat or dog to go to. The rats ought,

therefore, to be trapped alive and should be so killed that the fleas on them are destroyed at the same time.

(*b*) A dead rat should not be thrown away in the streets, but should either be removed direct to a place assigned for the purpose by the authorities or be burnt on the spot where it is discovered dead.

(*c*) The attention of the authorities should immediately be drawn to the spot where a dead rat is discovered so that they may promptly take steps to rid the site of any fleas thereon.

(*d*) Every plague case ought to be removed at once to a place supposed to be free from infected fleas, as continuance of the patient in the same house will lead to continuance of infection and preclude any possible chance of his recovery from the original infection.

(*e*) Removal to a Health Camp or to any other place must be accompanied by precautions to get rid of the in fected fleas from any articles, effects, or things which may be carried to such place.

" (2) The successive epidemics at Sydney have been, due not to "continuous" but to "repeated" infection which has always taken place "by sea" and which has generally been connected with the importation of produce."

This opinion, if correct, explains the repetition of plague in places like Poona, Sholapur, Baroda and other centres, sometimes after very long intervals, and also explains the continuance of plague in a city like Bombay, probably owing to continued infection by the importation of produce and of empty bags or of other articles likely to carry fleas with them, and, above all, by the importation of plague infected rats, whether they be *mus rattus* or *mus dceumanus.* This bears out the necessity of carrying out my suggestion repeatedly made in your paper for the prevention of the migration of rats from ship to shore and *vice versâ* if repeated infection is to be avoided.

Within the short space of a newspaper column I have not dwelt on exceptions to the observations noticed above. They must not, therefore, be taken to be invariable. To give only two instances : fleas may drop from a plague-infected rat on its passage and be the source of infection in the house without any apparent trace of the rat history. A man may visit a place in the native town and an infected flea catching his clothes may give him plague, or if he escapes the inoculation the flea may attack any other person or persons who may associate with the original man wherever he goes to.

Your crusade for inoculation with Haffkine's prophylactic is laudable, but I submit it requires modification.

All whose avocations necessarily associate them with places or who, owing to circumstances in life, are obliged to be in places where plague rats generally appear, such as wharfs, warehouses, shops, stables, dilapidated buildings, huts and upper floors of houses with objectionable roofs, must be inoculated. The rest, who can with tolerable certainty afford, either by circumstances or by precautions or by evacuation of the infected premises, to keep the flea at arm's length, need not be so inoculated.

PESTONJEE M. KANGA.

GOVERNMENT & PLAGUE.

Audi alteram partem.

TO THE EDITOR OF THE "TIMES OF INDIA."

SIR,—It is now a fortnight since the Government of India's policy on plague was declared as outlined in his Excellency the Viceroy's and in Sir Harold Stuart's communications to the Local Governments, but it is doubtful whether any good will at all come out of it unless practical measures are also suggested and initiated by the Government of India, and a treatise containing, in a popular form and in non-technical language, (1) the epidemiological observations made not merely by the Plague Commission of 1905, but also by other authorities in India, China, Japan and Australia, and (2) the indisputable conclusions based thereon, is published and circulated for the information of the general public, but particularly of every official who is responsible for the direction of plague measures in India.

It is satisfactory to find that the Government of India have at last, though tardily, hit upon a policy which is absolutely wise and correct, for though opinions may and will differ on the etiology of plague, no one now doubts for one moment that for some cause or other the rat is responsible for the perennial harvest of plague and

that no measures, which are not simultaneously directed towards excluding or avoiding rats as well as destroying them, are calculated to produce absolute results. Neither, therefore, Colonel Bannerman's crusade solely for inoculation, nor Dr. Turner's suggestions to the Bombay Government in his last report solely for the destruction of rats, is consistent with the conclusions arrived at by the Plague Commission of 1905, which confirm similar conclusions arrived at four years back and repeatedly tested by Dr. Ashburton Thompson of New South Wales and Dr. Ramsay Smith of South Australia. The Government of India has, therefore, rightly and wisely adopted the mean and laid stress on the importance of such sanitary measures in the shape of model dwellings and structural alterations as on the one hand "tend to secure freedom from rats by affording fewer facilities for rat life, and such measures as by protecting stores and promptly removing all garbage, have a direct effect on the rat population, which normally is limited only by the available supply of food." Whether the Government resolution is executed promptly and effectually is another matter; but for the time being the Government may be congratulated on appreciating for the first time the opinions of Australian authorities, which undoubtedly deserved consideration long since, and to which I drew the attention of the Health Officer of Bombay through the Municipal Corporation.

Dr. Weir, of the Bombay Health Department, from the very outset recognised the importance of the part played by the rodents in Bombay, and his report on the plague history is still admirable reading. His hands were, however, not strengthened by others who either refused to share his views or believed that it was impossible to destroy the rodents. It was not till after I moved some of the members of the Corporation and drew the Corporation's attention to the Australian reports on plague that Dr. Turner's report was out in 1905, admitting that it was a fact recognised by all authorities that the rat played an important part in the spread of plague and that he should be supplied with funds to poison them. Since then I have forwarded to the Bombay Corporation subsequent reports on plague by Dr. Ashburton Thompson, fully hoping that some tangible action would be taken on them. Failing in this I resorted to your columns from time to time, and in my very first letter, published on 12th November last, after referring to the Australian measures and recommendations, I suggested that our efforts should be concentrated on two points only, viz., (1) the destruction, and (2) the exclusion of rats.

After suggesting the formation of a committee of select persons and condemning the mere destruction of a certain number of rats in a given time and in a given locality, I suggested that a sufficient staff should be

employed to entrap, kill, or to poison rats simultaneously all over Bombay, if possible, but over the epizoötic area, at all events, and during the plague-free interval over the area which experience had shown to be the starting place of plague and the focus of danger I further suggested the employment of an intelligence staff to be constantly on the watch for and to search out rats, and I wound up that part of the subject by stating that without the expenditure of municipal funds steps could forthwith and easily be taken to prevent the spread of plague by seeing (1) that all rubbish and filth was properly scavenged, and that no rubbish or refuse was so placed as to attract rats towards it, and (2) (what was of greater importance) that minor structural repairs were made in every building so as to prevent, as far as possible, the access of rats to and harbourage of rats in or about the premises. As to the first point, it is a notorious fact that wherever in the city dust-bin carts are located, all kinds of filth, garbage, rubbish, etc., are constantly to be observed in heaps, giving an over-abundant supply of food to the rodents and cats and providing a very attractive place for them.

It is gratifying to find that every one of these suggestions has been at last now for the first time adopted and pressed by the Government of India. Could it then be justly said that the Government of India had hitherto taken all measures which science and experi-

once had suggested and that the same were resented by the classes of the community most affected? Destruction of rats is the only necessary measure resented so far on religious grounds, but it was so resented by an infinitesimally small section of the Hindu community. The measures which brought about a ferment some years back were either not well founded or were unnecessarily harsh, harassing, and oppressive. No wonder then if Mr. Morley joined with the Royal College of Physicians in their doubt "whether everything that can be done has been done by the responsible authority, and whether the last word of medical science and administrative skill has really been said." No wonder also if two of the eminent physicians in London strongly took exception to Lord Curzon's recent declaration in the *Times* that his administration had done all that science and experience could suggest to prevent plague, but it was only the people of India who were obstructive and apathetic. I am positive that even educated people know little of the observations on plague and much less do they know how to prevent it. Many have admitted to me that they could not follow the writings in your columns, though the same were intended to be penned in as simple a style as possible. Can you, therefore, expect the ignorant millions to know anything about plague without a proper and thorough guidance and without being properly educated and handled? All this

would entail a vast organisation, not necessarily of medical men, much less of Europeans entirely, who should approach and guide the public, and who should constantly be vigilant as to the measures being taken under their supervision, and should always be easily accessible to and be in touch with the people.

To begin, rat destruction has not yet gone on, at all events in Bombay, on the lines I suggested in your columns and now adopted by the Government of India, and, if a particular section objects to it, not much harm would be done to the measure by dropping it in the few cases. As plague is neither a contagious nor infectious disease (except in rare instances not to be taken notice of) in whatever localities or even individual houses the sanitary and scientific measures are adopted, the rats and, therefore, plague would be driven out of those localities and houses, and plague would be confined only to those centres or houses which do not co-operate in accepting those measures. Plague is not a respecter of persons as was once believed. Europeans are just as much affected as the coloured races under the same conditions; but the plague affects those in whose cases the conditions help the access of or offer an inducement to the rodents.

As I stated in your columns of 17th November, Government need not fear opposition from the adoption

of the methods I then suggested, and now that they have adopted those methods, they may well expect co-operation from at all events the majority of the people. Major Buchanan of Nagpore was able by tact and administrative skill to win over even the Jains and Marwaris. There is no reason to suppose that similar tact and skill will not meet with the same success elsewhere. The educated class having turned sceptical about the utility of any method by being told of conflicting opinions of medical gentlemen, it will be desirable for Government to publish and freely circulate a treatise suggested above, and I have the authority of Professor (Sir) Thomas Fraser, President of the First Plague Commission in India, to declare his emphatic opinion that, among other things, the houses should be well lighted and ventilated and built on the latest scientific principles if plague is to be avoided.

Colonel Bannerman's crusade for inoculation alone would be a wasteful measure, as the conditions giving rise to the cause will continue, and so would be the fate, and for the same reason, of Dr. Turner's recommendations to the Bombay Government for the destruction of rats on which they based their Resolution of the 26th June last. There can, therefore, be no room for doubt that model dwellings, built or reconstructed in the manner suggested by the results of the elaborate and instructive investigations of Major Lamb and

Captain Liston (to whom the public of India are greatly indebted for their painstaking exertions) are absolutely necessary.

As regards new buildings, there will be no difficulty. The Improvement Trust and the Military authorities have adopted and are carrying out the principle, and, so far as the servants' godowns built by the Military anthorities in Colaba and elsewhere on modern principles are concerned, I am assured by an eminent medical officer of this Presidency that construction of such godowns has invariably led to a marked diminution in plague incidence. The Improvement Trust chawls have not yet enjoyed the same immunity, because apart from the construction of the building, care should be taken not to create the conditions which breed or harbour rats and fleas, such as, for instance, by keeping bamboo matting, and such care would seem not to have been taken; hence the plague cases in Nagpada and Agripada chawls. In this connection it is important to notice that it has been the invariable experience of Dr. Sorab Nariman, of the Parsee Plague Hospital, that most of the plague cases admitted into the hospital were of persons who occupied floors next to the roof and the roof happened to be non-rat-proof.

On this point I venture to suggest that the Government, consistently with its recent policy, might modify

the present law as to the easement of light and air; for though I consider it is elastic enough to be interpreted liberally in tho light of our present knowledge, a doubt has been raised as to whether the English decision should not be stuck to in interpreting the Indian Law, but as English decisions do not favour the leaving of a large space between houses in towns, Professor Fraser's opinion and the Government policy would be a dead letter unless the Indian Law on the subject is more clearly defined and laid down.

The real difficulty, however, lies in inducing house-owners so to alter their houses as to comply with the new principles. This may be left to the good sense of the owners ; but if they are treated with tact, and if on inspection the essential points for alterations are pointed out, I have no doubt they would, for their own safety, adopt them. It would make little difference to the purse, at all events, of rich landlords to do so; but to bring about the general result the Government and the Municipality will do well in going out of their way by reducing the taxes or offering other inducements.

What is inexcusable is the continuance of dilapidated houses or of houses marked U. H. H. Why they are allowed to stand is a mystery; for they harbour rats, and no one would be more surprised than the Plague Commissioners to see such places all over the town directly

stultifying their conclusions. I would name only one instance of a half-pulled down bungalow of a rich landlord with its rubbish and filth allowed to continue for months past in such a healthy locality as the Nepean Sea Road side, and no responsible officer seems to be taking any notice of the same.

Another nuisance to which my attention was kindly drawn by one of the Plague Commissioners is the existence of gullies between houses in Bombay, which serve as a storage of all garbage, filth, etc., and, therefore, a convenient resort for the rodents. In this respect, as also in the style of roofs, Bombay differs from Calcutta and I pointed out in your columns in February last that the difference in the style of roofs might be one reason or the diminished population of the house rat in Calcutta. I might now add that the existence of these gullies in Bombay, which do not exist in Calcutta, is a potent factor which keeps up the rat population.

It is generally supposed that rats can be destroyed only by killing them, but we all know by experience that killing has only a partial effect. The best method is gradually to bring Bombay and other places on a level with towns in civilised countries; for, by starving the house-rat and giving him no place for shelter, the race will gradually become extinct, or will be confined to the houses of the poorest of the poor.

As regards the gutter rats in Bombay, which I believe originally catch plague and give it through fleas to the house rats, they need not be much feared as human beings come but seldom in contact with them.

All sullage water or discharge pipes in houses should be closed at each end by wire-netting or a metal sieve, and should be painted with red coal tar. Rats avoid places where such tar is deposited.

Red coal tar or ordinary bulk or crude kerosine oil should be deposited all over the premises, and particularly in rat haunts.

Cats and dogs may be kept on the premises to serve as traps for rat-fleas dropped from the rats, as also to frighten the rats out of the premises.

All methods of access by rats, either by trees or any other mode, should be closed.

Out-houses and stables, warehouses and shops, which are the commonest haunts of rats, should be carefully fumigated by hydro-carbon, a measure which has succeeded in Dharwar and other places on the Southern Maharatta Railway under the supervision of Dr. Chinoy.

Godowns at Mandvi and other places for the storage of grain and seeds should, as far as possible, be made rat-proof and flea-proof.

Floors of dwellings should be as smooth as possible without cracks and always swept clean of dust.

Keating's powder or pesterine or any such stuff may be kept in the house to drive out or kill fleas.

There should be as little furniture as possible in the house, or it should be so arranged as to afford few sheltering places to the rats.

Rats, either caught alive or poisoned, should not be thrown away but burnt, as the rats in themselves are not so dangerous as the fleas thereon, and the object is to destroy the fleas, which otherwise would leave their proper hosts to feed on other hosts. This accounts for the belief in Karachi in April last that the greater the number of rats killed the greater the spread of plague.

The drainage, wherever possible, should be opened up so as to lessen the sheltering places for rats. I undersatand that such a measure was adopted in Bangalore with remarkable effect on the rat population, and I need hardly remind the public of the views of the late Robert Knight and Dr. Blaney on the desirability of having open drainage in a city like Bombay.

The huts in Health Camps should be constructed of corrugated iron only.

Migration of rats from ship to shore and *vice versâ* should be put a stop to.

Every year plague reappears at and starts from Mandvi and the Fort, which are nearest the harbour, and the vessels bringing produce from other parts of India and from other countries and introducing infected fleas or infected rats, or both, in the godowns at Mandvi or in the Fort. Is it not then common-sense to infer that infection in Bombay is not continuous but most probably repeated every year, being conveyed by the sea through produce and bags, and that one reason why plague is kept up in India is that Bombay is continually contributing towards it and receiving it back in its turn ?

Lastly, I venture to suggest that a responsible plague officer may be appointed for each town, with a staff of inspectors under him and a Plague Director-General over all. Their duties should be confined only to plague questions and measures, and monthly reports should be despatched to the Director-General, who should also invite opinions of independent persons from different parts of India on the efficacy of any particular measure coming to their notice. The Government of India is quite right in advising the Secretary of State for India that there is no necessity to draw upon England for medical men. The purpose will be well

and even better served by the employment of the native element, medical or engineering.

I would suggest that bacteriological energy may be now directed towards the discovery of a curative serum, and every encouragement should be given by the Government for the trial of the existing serums, and further towards the discovery of a virus, which, if injected in rats, may spread a fatal disease among them without causing injury to human or other lives.

PESTONJEE M. KANGA.

Times of India,
18 September 1907.

WAR AGAINST RATS.

The Value of Cats.

TO THE EDITOR OF THE "TIMES OF INDIA."

SIR,—I have read with great interest the very excellent letter by Mr. Pestonjee Kanga which appeared in the *Times* of the 5th instant. There are many parts of the letter which one would like to repeat and emphasise. In making a few remarks on the subject I may say that any difference of opinion which I hold would be more regarding the order of precedence of the measures which he recommends rather than in regard to the measures themselves.

Mr. Kanga refers to my having induced Jains and Marwaris to co-operate in the rat-catching operations in Nagpur. The prejudices against rat-killing amongst these classes are exceedingly strong, and although many of them may be induced to allow their servants to remove rats, if they do not do it themselves, I am not certain if it is a wise policy to ask them to destroy rats by traps and poison in every part of India. I came to Amraoti in the early part of this year, and it seemed to me that the prejudice against rat-killing was stronger here than at Nagpur. There are, however, a

great many rats in the district, and as most of the Jains and Marwaris now keep cats, it has been considered advisable to avoid asking them to use traps and poison.

The value of the cat in plague prevention has not yet been sufficiently recognised. About a year ago my attention was drawn to a small village, which lies on the roadside between two places that had frequently been infected by plague and which had hitherto been immune from plague. The headman explained that there were practically no rats because there were so many cats. Following up the hint it was found that many villages apparently owed their immunity to the presence of numerous cats.

The next step was the taking of a cat census in the Amraoti district, with a view to finding out, first, whether there were many cats in the district, and, second, whether it was likely that they would be valuable in preventing plague. It was estimated that there were about thirty-three thousand cats in the district, and as there had been 5,000 (odd) deaths from plague in the last plague season, there was a good opportunity of testing whether cats were really of value in preventing plague. In order to obtain a figure for comparison of villages the percentage of cats to houses was worked out for 1,017 villages. This part of the enquiary was

done by the Revenue officials. Afterwards the number of deaths from plague was inserted opposite the name of each village in the Civil Surgeon's office, so that manipulation of statistics to suit any particular view would, as far as possible, be avoided. A copy of the report giving the details is sent with this letter, but the leading points are as follows. The villages were divided into three groups—

	No. of villages.	Deaths.
Under 20 per cent. cases to houses ...	357	3,258
20 to 50 per cent..........................	514	550
Over 50 per cent.	146	14

On further investigation it was found that in one village in which there had been 13 deaths, although the cat percentage was over 50, most of the cats were brought in after the plague epidemic. It would thus seem to be a rule that a village with 50 per cent. cats to houses will be free from plague.

Other investigations were made in villages in which plague had recently been prevalent, and comparisons were made between houses in which cats were present and houses without cats. In every instance it was found that the number of plague cases was much less in the houses where cats were present. Before

plague breaks out it is well known now that rats are very numerous, and one cat is not sufficient to keep away all the rats, but there is a good deal of evidence that a house with three good cats, that are not over fed, will be free from plague.

Mr. Kanga states that the Government has now hit on a policy which is absolutely wise and correct. The essential element in the present policy is scrupulous consideration for the wishes and traditions of the people, and the wisdom of this policy will be apparent to any one who considers that the disease is spread by an animal that lives in the houses of the people. Now it so happens that the traditions among the people are exceedingly strong in favour of keeping cats. There are many references to the cat in the sacred books of the Mahomedans: the Hindu who kills a cat is subject to a heavy penalty, and the Marwari who so strongly objects to killing rats is very willing to keep a cat. Most of the Marwaris have already got cats in this part of the country. It is, therefore, I think a better policy to advise Marwaris to keep cats and to avoid asking them to use traps and poison. At any rate a knowledge of this fact affords a means whereby rat extermination can be carried on without risk of offending the religious prejudices of the people generally. For the poor traps and poison: for the wealthy Jain and Marwari cats.

Mr. Kanga refers to the policy of "Inoculation alone" as being a wasteful measure, as the conditions giving rise to it would continue, and he thinks that the policy of rat destruction would be equally unsuccessful for the same reason. It is true at any rate there is a want of finality in these measures: it would be necessary to repeat them year after year; but if the keeping of cats is encouraged as the cats increase in numbers the rats would diminish. Year by year the difficulty of rat removal would become less, and in a few years we should be able to keep in check the swarms of rats that invariably precede a severe epidemic.

Mr. Kanga advocates the construction of model dwellings. The idea of model dwellings is excellent, but it is probable that centuries will have passed before a sufficient number of model dwellings will have been erected to make any great difference in the death-rate from plague. In the meantime why not try and introduce more cats? There is a good deal of difficulty in convincing some people that rats are the cause of plague, but the argument that appeals to them most strongly is a demonstration of the fact that a group of houses with many cats will be free from plague. The model house, from a plague prevention point of view, is the house with a cat.

Our present position in regard to plague prevention might be summed up as follows: Plague is a disease

that is spread by an animal that lives in our houses. There is no fact more widely known among the people of this country than that the natural enemy of that animal is the cat. The keeping of cats fits, in in a remarkable way, with the religious ideas and traditions of the people. Our present policy is scrupulous consideration for the wishes and traditions of the people. Everything then, natural history, religion, tradition, policy, and practice, points to the cat as being a most valuable help in our campaign against plague. Inoculation may take us over a difficulty temporarily: evacuation is a recurring nuisance: rat-destruction by traps and poison is liable to be objected to by some classes: and the reconstruction of houses will be a matter of centuries; but if the keeping of cats is encouraged we shall have means whereby rat destruction can be carried without fear of giving offence, and with a feeling of confidence that as the cats become more numerous, the number of rats to be destroyed will be less. We have made the first step on solid ground in recognising that rats are the cause of plague epidemics. Will it not be the second step when we realise that the best way to prevent the disease is to employ the natural enemy of the animal that is responsible for its spread?

A. Buchanan, Lt.-Col., I.M.S.

Times of India,
25 October 1907.

THE PLAGUE PROBLEM.

Rats and Rat Destruction.

TO THE EDITOR OF THE "TIMES OF INDIA."

SIR,—Nobody who has attemped to study the plague problem can fail to appreciate the value of the services done by the *Times of India* in writing leader after leader on this most important yet much neglected subect, and if I follow your example in writing again on the subject to cry in the wilderness, I am sure you will not abandon my company. In your leader in the issue of the 21st you have gone to one extreme by attaching undue importance to one line of the campaign. I, therefore, crave liberty to refer to the only and proper course for the public to adopt, regardless of all mere theories, if plague is to be eradicated from this country, *viz.*, (1) the destruction and (2) the exclusion of rats.

Without wishing or intending to belittle inoculation, which is undoubtedly a most valuable aid to plague prevention, it is necessary to know that inoculation is a measure inducing only temporary safety, and not calculated to remove the conditions which give rise to plague. So long as, therefore, such conditions continue, inoculation alone in a city like Bombay will not be the safest

measure to follow, unless every man in Bombay is inoculated: but as many of the inhabitants live such a life or so control the circumstances as not to bring them into contact with either the infected fleas or the plague bacilli they will not seek inoculation and yet will be exposed to risk by going to places where there is no human plague on account of the people being inoculated, but where the plague conditions such as infected fleas, etc., continue to exist. Plague will, therefore, not be eradicated for centuries if we relied on the sanitary measures in the sense used by you or on inoculation alone. I therefore venture to lay specific stress again on the importance of what I would substitute "rat" for "sanitary" measures for the exclusion of rats or for the destruction of rats either by killing or starving them. They are neither impracticable nor costly. A chief part of these measures does not require the co-operation of the people at all. The Municipality itself should set an example to the public by keeping the town scrupulously clean, by promptly and regularly removing all filth and garbage, which is constantly noticeable all over the town, whether it be in the slums of the city or in the fashionable quarters thereof. They should at the same time pull down all houses which are unoccupied on account of their being marked unfit for human habitation or because they are half pulled down.

Then as regards the conditions in the houses, the educated residents, if properly approached, would allow, if not adopt, such measures as the stoppage, by minor structural alterations, of all access to their houses by rats, or the deposit of coal tar and other stuffs like crude petroleum or bulk oil which frighten the rats away. Let alone the houses where people would not co-operate in the adoption of such measures; but I cannot imagine any sect or community who would object to the adoption of such innocent measures.

As regards the destruction of rats, I repeat that the rat destruction is not carried on yet on the lines which one should see adopted. Here again the example of Australia ought to be followed as to the modes adopted for searching out and catching rats. At present only about thousand a day are killed, when efforts should be made to destroy at least 20,000 before the epizoötic commences. May I again venture to dwell on the inadvisability of poisoning rats when it is too late, *i. e.*, after the plague amongst them has commenced? We all now know that the fleas leave the body of the rat after death. To poison, therefore, a plague rat when it is on the verge of death would be to assist in the spread of infected fleas which till the death of the rat stick to its body. Unless the death of a poisoned rat can be immediately detected and the carcase then and there burnt the chances are unintentionally to spread

more plague instead of stopping it. It is not generally known that fleas do not catch infection from the plague rat until the latter is in a septic condition. There is no danger from a rat or a rat-flea so long as there is no epizoötic plague and so long as the plague rat has not assumed a septic condition. It is only then that the danger commences, and luckily there is not such a multitude of infective agents as you state, but all the same it is necessary to combat it beforehand by taking measures during the plague—free interval to destroy as many rats as possible and to reduce the number of rat haunts and the filth outside, and, wherever possible, inside the houses and the drains (public and private) so that the population of rats may naturally become extinct.

Here I may take the opportunity of again bringing to the notice of the authorities, now that we have amongst us a Governor pre-eminently fitted to deal with this subject on the right lines, that the authorities should really direct their efforts to that part of Bombay where year after year the plague takes its start and which becomes a centre of infection and in its turn creates other like centres. This part is again Mandvi this year as will be noticed from the daily results of the mortality in the rat population. No efforts appear to have been made to destroy that centre of infection by taking most stringent measures, sanitary either in your sense or my sense, first, by altering the condition

of the grain godown, and, secondly, by preventing the migration of rats from ship to shore. I repeat that the adoption of measures which I have suggested need not be put back and Government need not be deterred in its measures by the insignificant number of people objecting to the destruction of rats and the best illustraton of it is found in a telegram from Allahabad published in your issue of the 21st which shows the extraordinary proportion of the mortality amongst the Hindus and Mahomedans in consequence of the campaign against rats having been neglected by the Hindus. Make your house a castle against the rat and it will not think it worth its while to visit it where it can find neither habitation nor food. It will visit the houses which continue to be unprotected and plague will be confined to such houses only.

While Government have done wisely in dropping their resolution of 17th January, 1906, which directed the inspection of travellers by Railway, roads and steamships, it is to be hoped that the Government will not go to the other extreme by abandoning the inspection and disinfection by fumigation or sun-exposure of the materials, beddings, etc., carried by travellers. I do not know if such inspection and disinfection were continued at Panchgani this year, for it has taken plague from Wai and the adoption of measures directing the people to go to their respective shops every day and

to sweep them has brought about grave consequences to this fine sanitarium. From Panchgani plague has spread to Mahableshwar.

Instead of having Ward Committees suggested by you I would suggest a "round table conference" of men of sound judgment who have studied this subject and who need not necessarily be medical gentlemen, with the Governor as their President, where the different points of view may be discussed and threshed out and measures based on such discussion may be formulated and adopted following in the footsteps of the Hon'ble Sir John Hewett's Government which is the only Government throughout India which has taken active and prompt measures in the right direction and in the right time with promising results.

PESTONJEE M. KANGA.